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FIG. 1

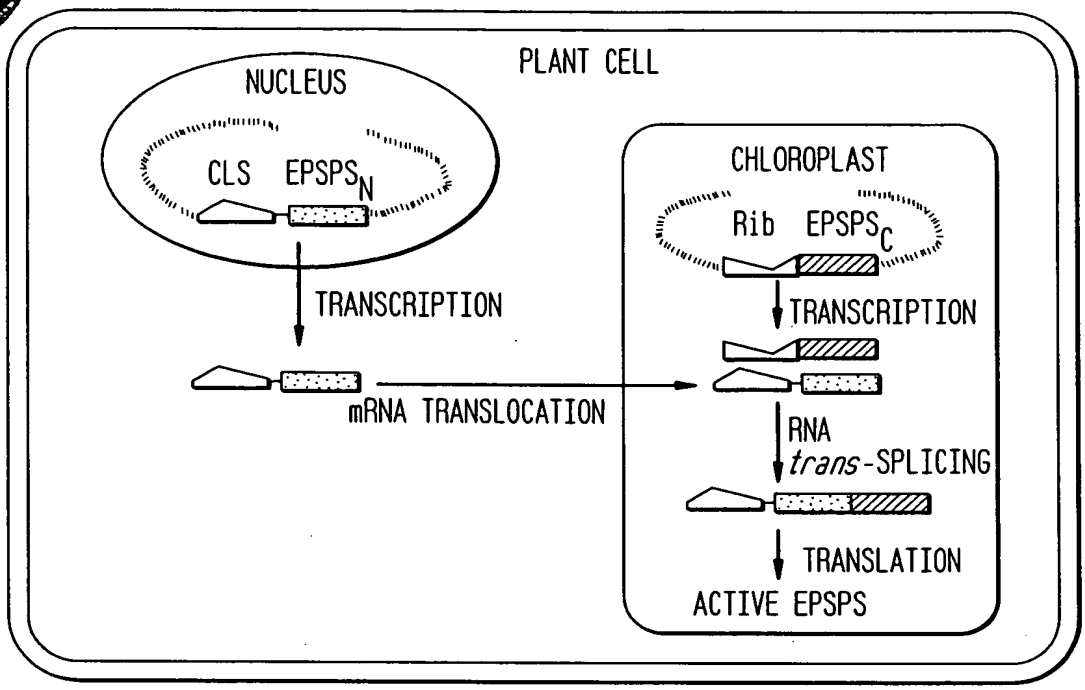


FIG. 2

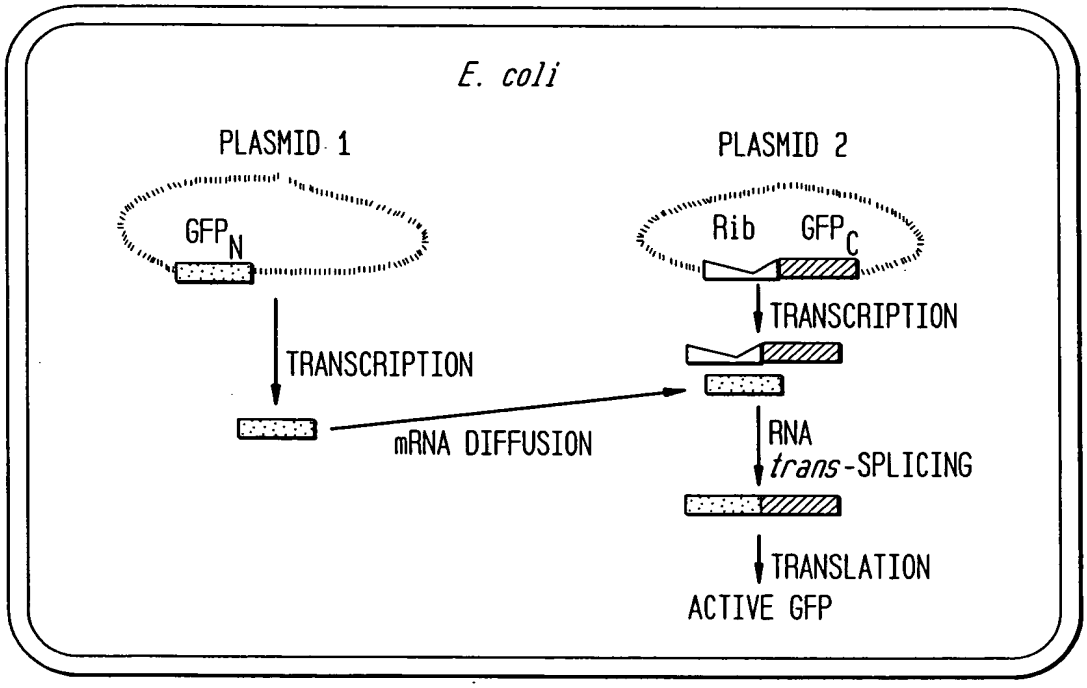


FIG. 3

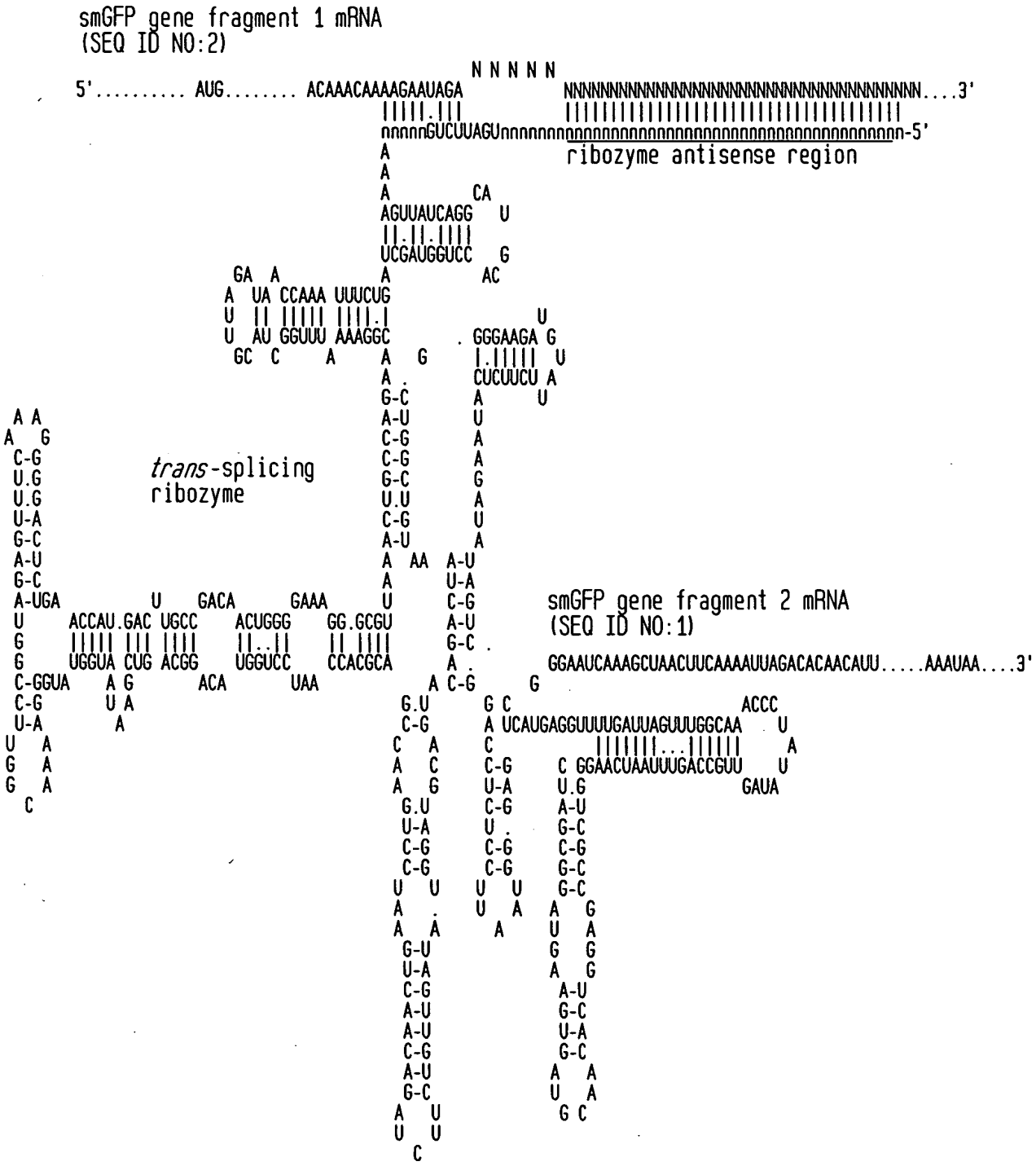
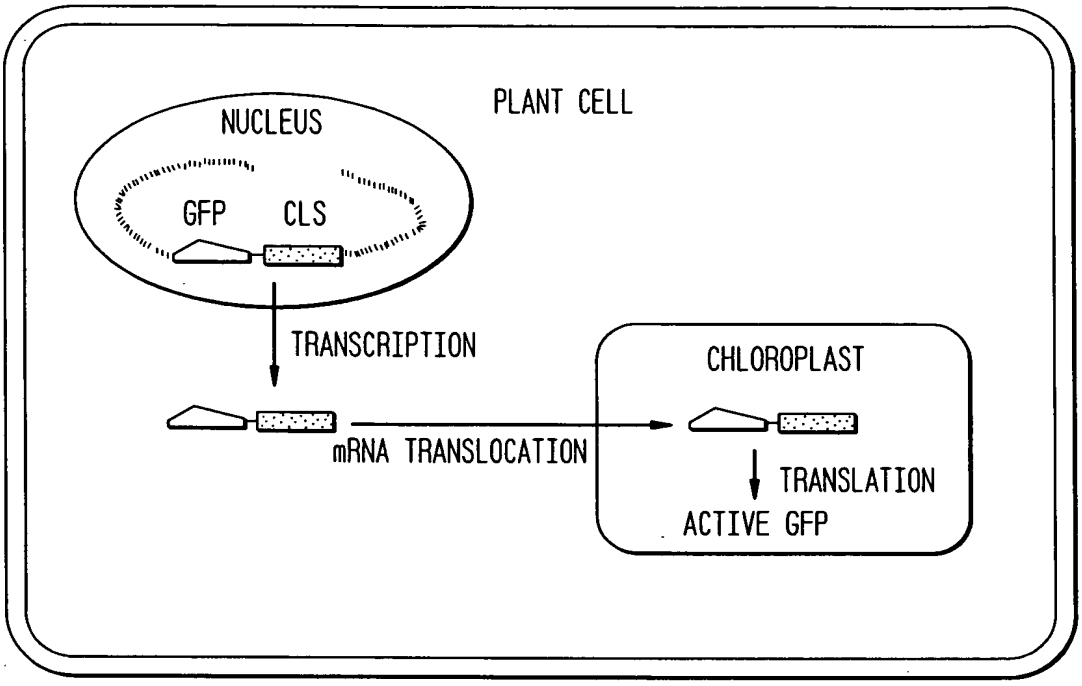

smGFP gene fragment 1 mRNA
(SEQ ID NO:2)
5'..... AUG..... ACAAACAAAAGAAUAGA
N N N N N
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN....3'
nnnnnGUCUUAGUnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn-5'
ribozyme antisense region
trans-splicing
ribozyme
smGFP gene fragment 2 mRNA
(SEQ ID NO:1)
GGAAUCAAAGCUAACUUCAAAAUUAGACACAACAUU.....AAAUAA....3'

FIG. 4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GFP
CLS
TRANSCRIPTION
CHLOROPLAST
mRNA TRANSLOCATION
TRANSLATION
ACTIVE GFP

FIG. 5

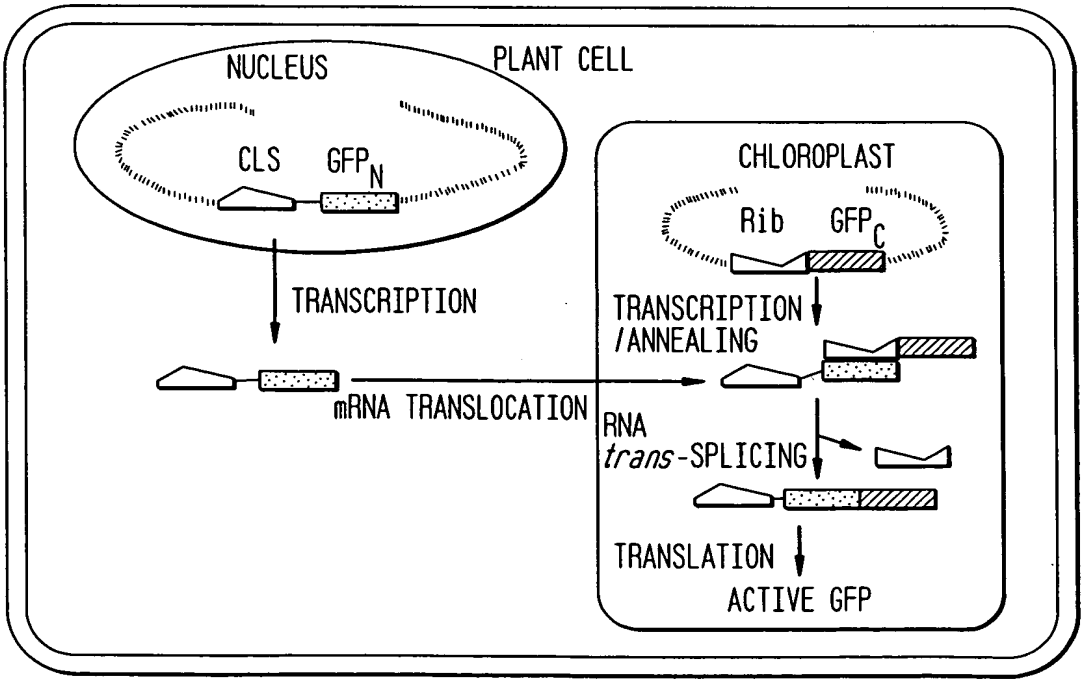
PLANT CELL
NUCLEUS
CLS
GFP$_N$
TRANSCRIPTION
CHLOROPLAST
Rib
GFP$_C$
TRANSCRIPTION /ANNEALING
mRNA TRANSLOCATION
RNA *trans*-SPLICING
TRANSLATION
ACTIVE GFP

FIG. 6

SEQ ID NO:3

```
   1  tttattagaa caagaagtga ggatatgatt aaactttgtt tgacgaaacc
  51  aggtctgttc cgactttccg actctgagtt tcgacttgtg agagaaggag
 101  gagtcgtggt gaacttttat taaaaaaatt agttcactcg tcttcaatct
 151  cttgatcact tcgtctcttc agggaaagat gggaagaaca ctgatgagtc
 201  tcgcaaggtt tactcctcta tcttcattgt ttttttacaa aatcttg
```

FIG. 7

FIG. 8A

pVUG1 segment 5689-6757
(SEQ ID NO:4)

5689 tttattagaa caagaagtga ggatatgatt aaactttgtt tgacgaaacc

5739 aggtctgttc cgactttccg actctgagtt tcgacttgtg agagaaggag

5789 gagtcgtggt gaacttttat taaaaaaatt agttcactcg tcttcaatct

5839 cttgatcact tcgtgctagc atgtatttgg caaatcaaat accatggtct

5889 aataatcaaa cattctgatt agttgataat attagtatta gttggaaatt

5939 ttgtgaaaga ttcctatgaa aagtttcatt aacacggaat tcgtgtcgag

5989 tagaccttgt tgttgtgaga attcttaatt catgagttgt agggagggat

6039 ttATGAGTAA AGGAGAAGAA CTTTTCACTG GAGTTGTCCC AATTCTTGTT

6089 GAATTAGATG GTGATGTTAA TGGGCACAAA TTTTCTGTCA GTGGAGAGGG

6139 TGAAGGTGAT GCAACATACG GAAAACTTAC CCTTAAATTT ATTTGCACTA

6189 CTGGAAAACT ACCTGTTCCA TGGCCAACAC TTGTCACTAC TTTCTCTTAT

6239 GGTGTTCAAT GCTTTTCAAG ATACCCAGAT CATATGAAGC GGCACGACTT

6289 CTTCAAGAGC GCCATGCCTG AGGGATACGT GCAGGAGAGG ACCATCTCTT

6339 TCAAGGACGA CGGGAACTAC AAGACACGTG CTGAAGTCAA GTTTGAGGGA

6389 GACACCCTCG TCAACAGGAT CGAGCTTAAG GGAATCGATT TCAAGGAGGA

6439 CGGAAACATC CTCGGCCACA AGTTGGAATA CAACTACAAC TCCCACAACG

6489 TATACATCAC GGCAGACAAA CAAAAGAATG GAATCAAAGC TAACTTCAAA

6539 ATTAGACACA ACATTGAAGA TGGAAGCGTT CAACTAGCAG ACCATTATCA

6589 ACAAAATACT CCAATTGGCG ATGGCCCTGT CCTTTTACCA GACAACCATT

6639 ACCTGTCCAC ACAATCTGCC CTTTCGAAAG ATCCCAACGA AAAGAGAGAC

6689 CACATGGTCC TTCTTGAGTT TGTAACAGCT GCTGGGATTA CACATGGCAT

6739 GGATGAACTA TACAAATAA

FIG. 8B

pVUG2 segment 5689-6757
(SEQ ID NO:5)

5689 acttgtgaga gaaggaggag tcgtggtgaa cttttattaa aaaaattagt

5739 tcactcgtct tcaatctctt gatcacttcg tctcttcagg gaaagatggg

5789 aagaacactg atgagtctcg caaggtttac tcctctatct tcattgtttt

5839 tttacaaaat cttggctagc atgtatttgg caaatcaaat accatggtct

5889 aataatcaaa cattctgatt agttgataat attagtatta gttggaaatt

5939 ttgtgaaaga ttcctatgaa aagtttcatt aacacggaat tcgtgtcgag

5989 tagaccttgt tgttgtgaga attcttaatt catgagttgt agggagggat

6039 ttATGAGTAA AGGAGAAGAA CTTTTCACTG GAGTTGTCCC AATTCTTGTT

6089 GAATTAGATG GTGATGTTAA TGGGCACAAA TTTTCTGTCA GTGGAGAGGG

6139 TGAAGGTGAT GCAACATACG GAAAACTTAC CCTTAAATTT ATTTGCACTA

6189 CTGGAAAACT ACCTGTTCCA TGGCCAACAC TTGTCACTAC TTTCTCTTAT

6239 GGTGTTCAAT GCTTTTCAAG ATACCCAGAT CATATGAAGC GGCACGACTT

6289 CTTCAAGAGC GCCATGCCTG AGGGATACGT GCAGGAGAGG ACCATCTCTT

6339 TCAAGGACGA CGGGAACTAC AAGACACGTG CTGAAGTCAA GTTTGAGGGA

6389 GACACCCTCG TCAACAGGAT CGAGCTTAAG GGAATCGATT TCAAGGAGGA

6439 CGGAAACATC CTCGGCCACA AGTTGGAATA CAACTACAAC TCCCACAACG

6489 TATACATCAC GGCAGACAAA CAAAAGAATG GAATCAAAGC TAACTTCAAA

6539 ATTAGACACA ACATTGAAGA TGGAAGCGTT CAACTAGCAG ACCATTATCA

6589 ACAAAATACT CCAATTGGCG ATGGCCCTGT CCTTTTACCA GACAACCATT

6639 ACCTGTCCAC ACAATCTGCC CTTTCGAAAG ATCCCAACGA AAAGAGAGAC

6689 CACATGGTCC TTCTTGAGTT TGTAACAGCT GCTGGGATTA CACATGGCAT

6739 GGATGAACTA TACAAATAA

FIG. 8C

pVUG3 segment 6833-7901
(SEQ ID NO:6)

6833 tcttcaggga aagatgggaa gaacactgat gagtctcgca aggtttactc

6883 ctctatcttc attgtttttt tacaaaatct tgtttattag aacaagaagt

6933 gaggatatga ttaaactttg tttgacgaaa ccaggtctgt tccgactttc

6983 cgactctgag tttcgctagc atgtatttgg caaatcaaat accatggtct

7033 aataatcaaa cattctgatt agttgataat attagtatta gttggaaatt

7083 ttgtgaaaga ttcctatgaa aagtttcatt aacacggaat tcgtgtcgag

7133 tagaccttgt tgttgtgaga attcttaatt catgagttgt agggagggat

7183 ttATGAGTAA AGGAGAAGAA CTTTTCACTG GAGTTGTCCC AATTCTTGTT

7233 GAATTAGATG GTGATGTTAA TGGGCACAAA TTTTCTGTCA GTGGAGAGGG

7283 TGAAGGTGAT GCAACATACG GAAAACTTAC CCTTAAATTT ATTTGCACTA

7333 CTGGAAAACT ACCTGTTCCA TGGCCAACAC TTGTCACTAC TTTCTCTTAT

7383 GGTGTTCAAT GCTTTTCAAG ATACCCAGAT CATATGAAGC GGCACGACTT

7433 CTTCAAGAGC GCCATGCCTG AGGGATACGT GCAGGAGAGG ACCATCTCTT

7483 TCAAGGACGA CGGGAACTAC AAGACACGTG CTGAAGTCAA GTTTGAGGGA

7533 GACACCCTCG TCAACAGGAT CGAGCTTAAG GGAATCGATT TCAAGGAGGA

7583 CGGAAACATC CTCGGCCACA AGTTGGAATA CAACTACAAC TCCCACAACG

7633 TATACATCAC GGCAGACAAA CAAAAGAATG GAATCAAAGC TAACTTCAAA

7683 ATTAGACACA ACATTGAAGA TGGAAGCGTT CAACTAGCAG ACCATTATCA

7733 ACAAAATACT CCAATTGGCG ATGGCCCTGT CCTTTTACCA GACAACCATT

7783 ACCTGTCCAC ACAATCTGCC CTTTCGAAAG ATCCCAACGA AAAGAGAGAC

7833 CACATGGTCC TTCTTGAGTT TGTAACAGCT GCTGGGATTA CACATGGCAT

7883 GGATGAACTA TACAAATAA

FIG. 9

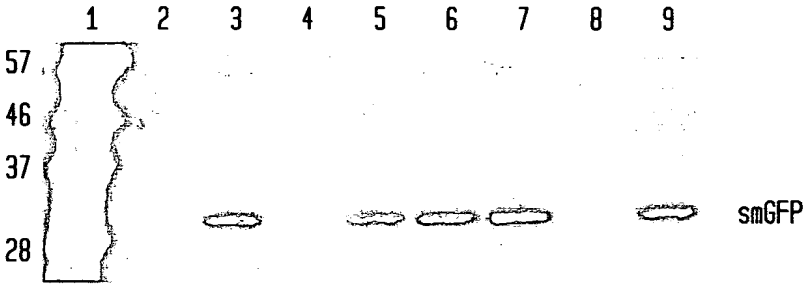

FIG. 10

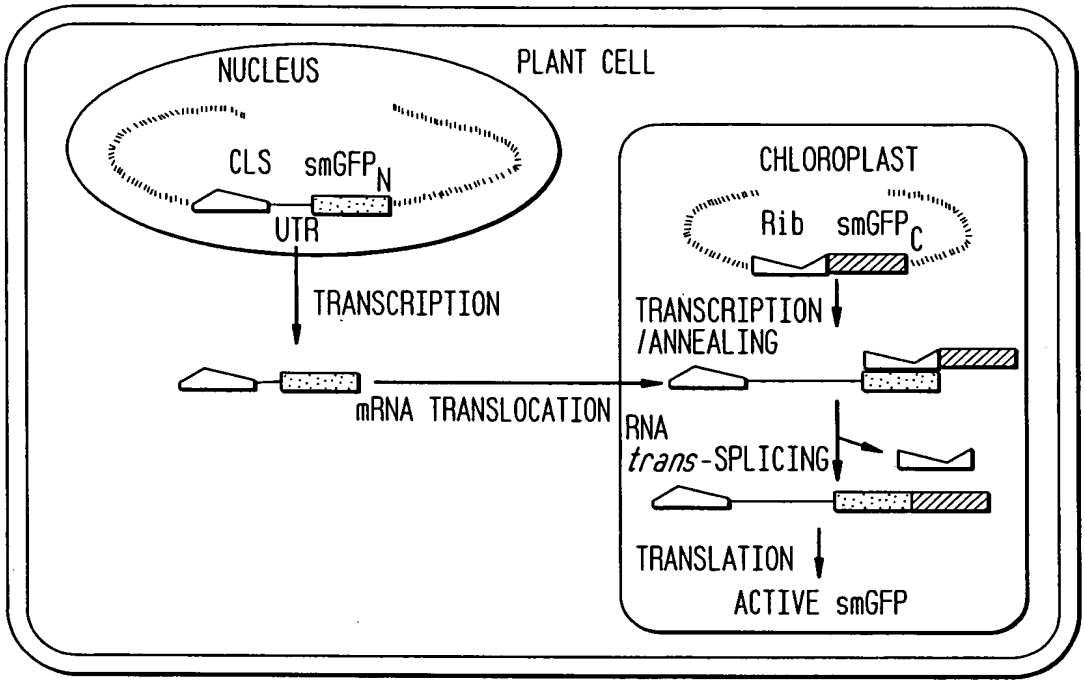
PLANT CELL
NUCLEUS
CLS
smGFP$_N$
UTR
TRANSCRIPTION
mRNA TRANSLOCATION
CHLOROPLAST
Rib
smGFP$_C$
TRANSCRIPTION /ANNEALING
RNA *trans*-SPLICING
TRANSLATION
ACTIVE smGFP

FIG. 11A

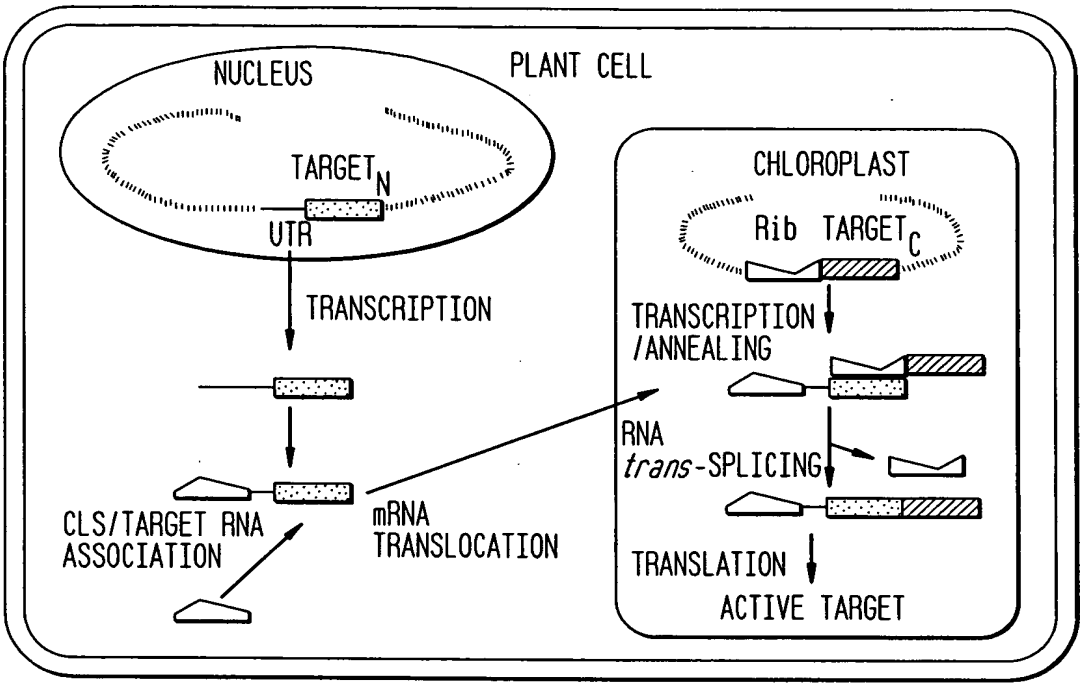

FIG. 11B

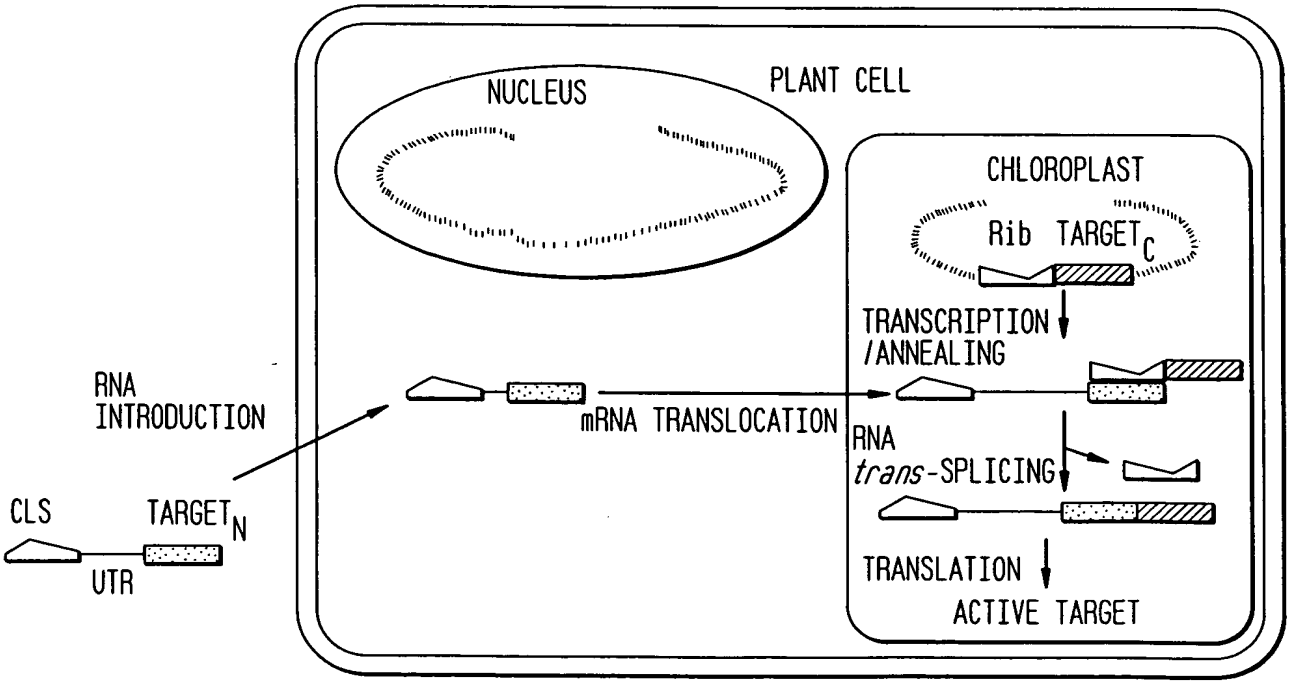

FIG. 11C

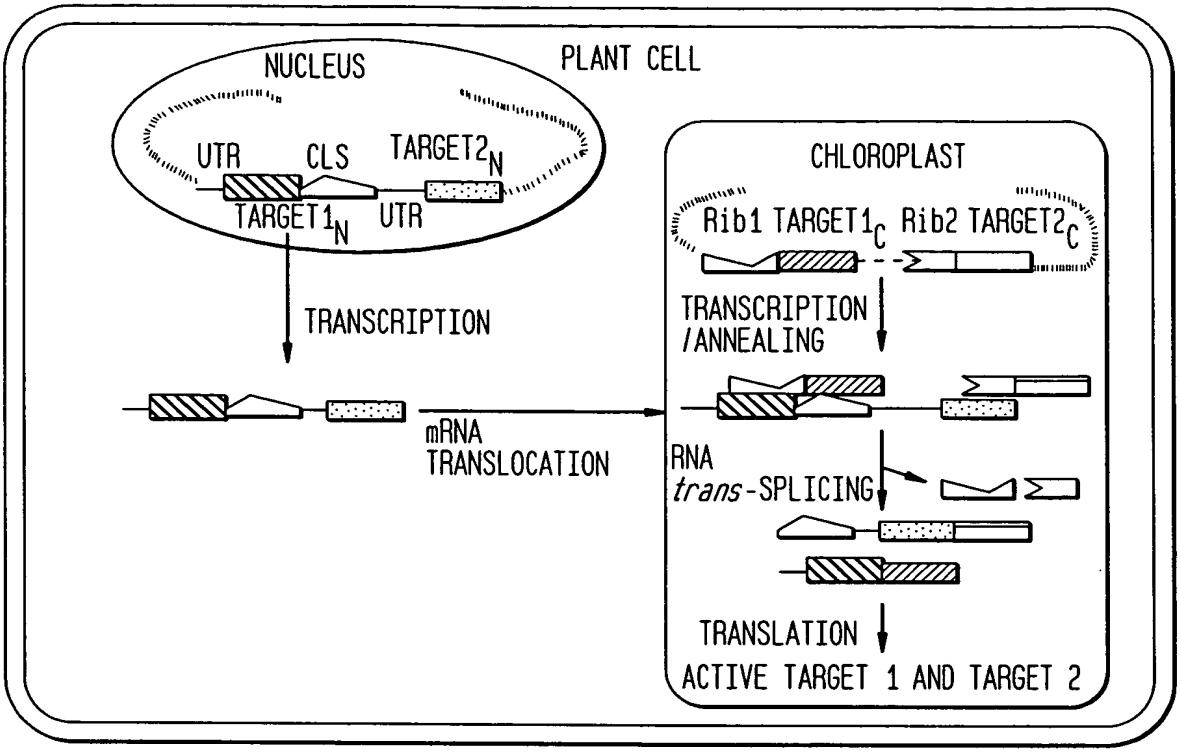

FIG. 11D

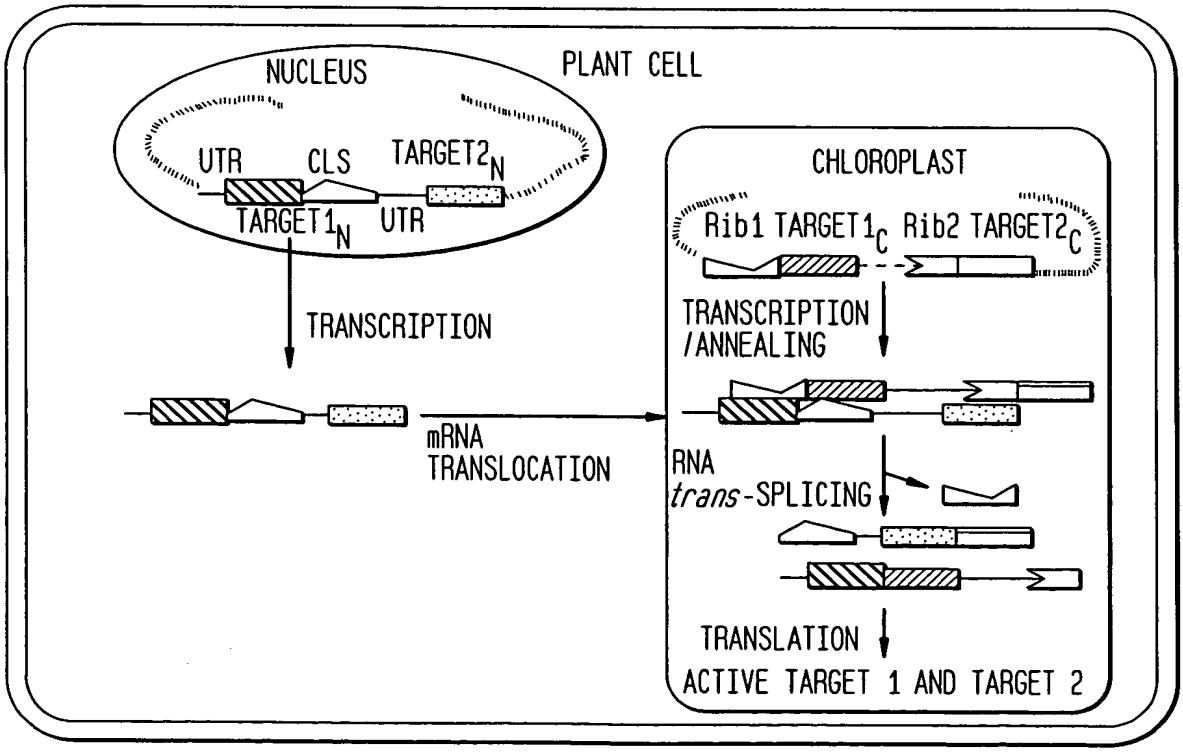

FIG. 11E

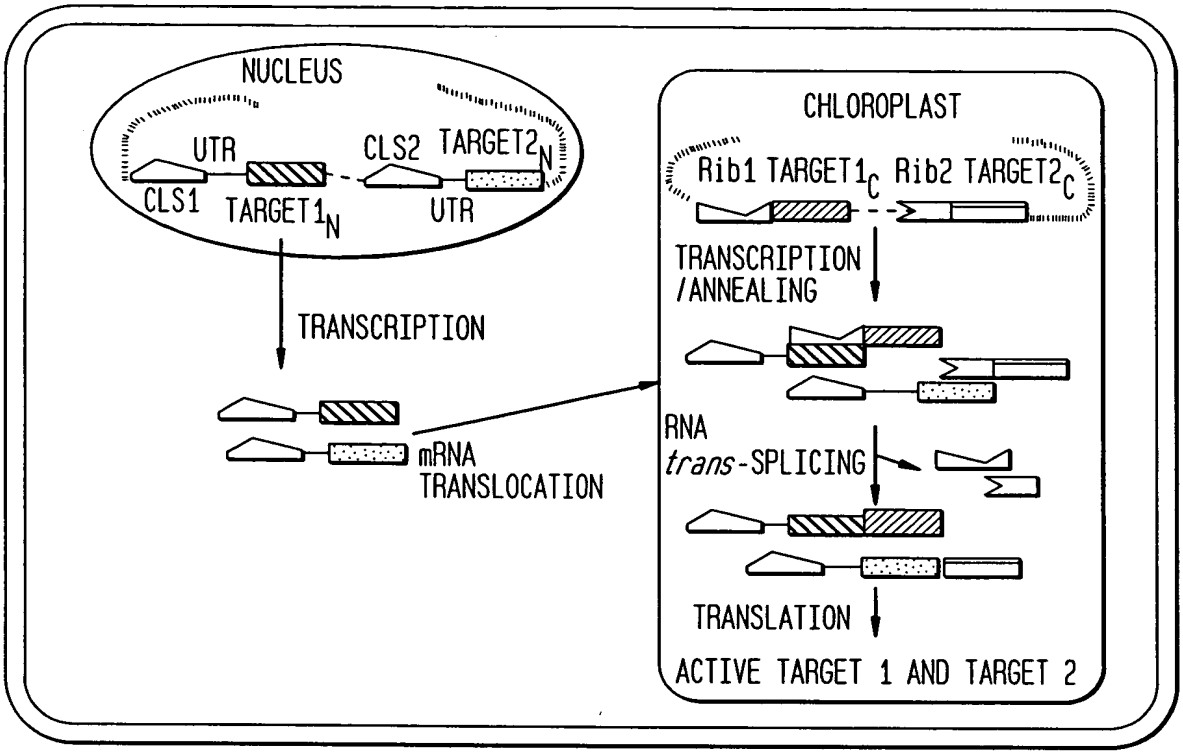
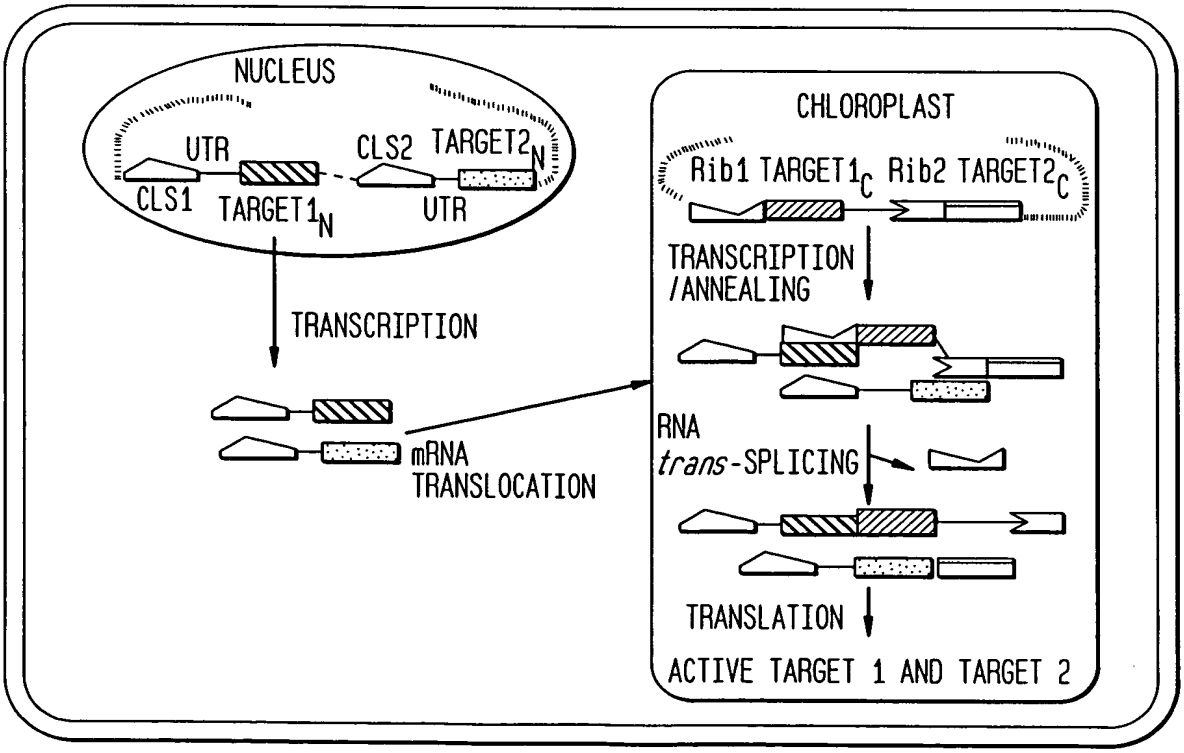
FIG. 11F